REMARKS

Claims 12-13, 26, 28, 79, 111-126, 131-133, 146-148, 150-153 and 155-158 are pending. Reconsideration of the pending claims is respectfully requested.

Claims 1, 20-21, 27, 31-35, 76-78, 80-110, 127-130, 134-145, 149, 154 and 156 have been cancelled without prejudice to their future prosecution. These claims are subject to restriction and within a non-elected group of claims. Applicant reserves the right to file divisionals on the non-elected claims.

Claims 12-13, 26, 28, 79, 111, 116, 119-121, 131-133, 146-148, 152-153, 155, and 157-158 have been amended. Support for the amendments is in the claims previously considered. No new matter has been added with the amendments. The amendments are intended to merely clarify language used in the claims, and the scope of the claims is intended to be the same after the amendment as it was before the amendment.

Rejections under 35 U.S.C. § 112(2).

The Examiner rejected Claims 12-13, 79, 125-126 and 133 under Section 112(2) for the use of indefinite claim language.

The claims have been amended as suggested by the Examiner to recite the term "low-k" dielectric layer for purposes of antecedent basis.

Accordingly, it is submitted that the claims fully comply with the requirements of Section 112(2), and withdrawal of this rejection is respectfully requested.

Rejection of Claims under 35 U.S.C. 103(a)

The Examiner rejected Claims 12-13, 20-21, 26-28, 79, 111-113, 116-119, 123, 125-126, 131-132 and 142-158 under Section 103(a) as obvious over USP 4,508,591 (Bartlett) in view of USP 6,198,133 (Yamazaki). The Examiner rejected Claims 114-115, 120-122, 124 and 133 under Section 103(a) as obvious over Bartlett in view of Yamazaki, further in view of USP 6,309,926 (Bell). These rejections are respectfully traversed.

The Examiner maintains that Applicant's method is made obvious by modifying Bartlett's process with Yamazaki's etch solution to achieve an etch rate of a low-k dielectric layer of greater than 1000 Å/minute. The Examiner cites to Yamazaki for teaching "a typical removal

rate of silicon oxide (low-k dielectric) at 800-1100 Å/minute using acetic acid and inorganic fluoride-comprising compound." (Office Action at page 4, 2nd par.)

First of all, the combination of Bartlett and Yamazaki would not provide Applicant's method as claimed. Both references teach ammonium fluoride as the major component — not hydrofluoric acid.

Yamazaki in Embodiment 4 (referring to FIGS. 6A-6G) describes a typical etch rate of 800-1100 Å/minute for a silicon oxide/nitride film using an etchant of HF:NH_4F:acetic acid in a ratio of 1:50:50.

Bartlett particularly teaches the use of a wet etchant of NH_4F and citric acid — in order to overcome problems of photoresist lifting using prior art etchants of NH_4F and HF or acetic acid.

Neither Bartlett nor Yamazaki teach or suggest the use of an HF:organic acid solution to remove dielectric material — particularly a 2:1 (v/v) solution of HF:organic acid which achieves rapid and selective removal of dielectric, particularly at a rate of greater than about 2000 Å/minute.

Furthermore, contrary to the Examiner's proposal, there is no motivation to substitute Yamazaki's etch solution for Bartlett's etch solution. Bartlett is directed toward preserving a resist layer overlying the oxide layer.

Bartlett discloses that prior art silicon oxide wet etchants made of NH_4F with the addition of either HF or acetic acid did *not* solve problems of resist lifting and undercutting with a PMMA photoresist (col. 3, lines 3-15):

> In the prior art, acetic acid or hydrogen fluoride was predominately used as the complexing agent. Since the amount of undercutting and resist lifting which occurs during the etch process also depends upon the chemistry of the photoresist/oxide interface, VLSI processing involving a PCM technique encountered severe etch problems regardless of the proportion of the NH_4F to HF in the etch bath. Acetic acid/ NH_4F solutions showed an improvement with respect to gross resist lifting, however severe undercutting was still a major problem. Further testing revealed that prior art techniques directed at improving resist adhesion would not work with PMMA....

To solve the problem of resist lifting, Bartlett teaches the use of a particular wet etchant of <u>NH_4F</u> and <u>citric acid</u> (col. 3, lines 35-55; emphasis added):

> The present invention discloses the development of a new etchant bath comprising a new organic complexing agent which reduces surface diffusion of the etchant into the resist, thereby resulting in symmetrical lateral etching and uniform patterns. The characteristics of the new complexing agent require that the agent should be an organic acid which is water soluble. The agent must also be available in very high purity and contain extremely low levels of trace metal contamination such as sodium, potassium, and iron which would contaminate the integrated

> circuit. Several acids which met the above criterion were tested, including: glutaric, tartaric, lactic, ascorbic and citric. *Citric acid was selected as the new complexing agent because it met the above criteria and was easily dissolvable in H_2O, while having a very complex molecular structure which limited its ability to undercut or lift the PMMA resist layer 2.*
>
> A preferred embodiment of the present invention may be constructed by mixing 6600 ml of H_2O with 1000 ml 40% aqueous Ammonium Fluoride and 550 gm Citric Acid....

A person skilled in the art reading Bartlett's disclosure and particular use of a NH_4F:citric acid etchant to preserve the photoresist layer would not be motivated to substitute with another etchant formulation.

Further, the disclosure in Bartlett cited by the Examiner — "the concentration of *these chemicals* primarily affect the etch rate of silicon dioxide" (col. 4, lines 1-5; emphasis added) — refers specifically to an etch solution of NH_4F and citric acid, <u>not</u> of other compounds or etch solutions in general (cols. 3-4, bridging par.; emphasis added):

> A preferred embodiment of the present invention may be constructed by mixing 6600 ml of H_2O with 1000 ml 40% aqueous Ammonium Fluoride and 550 gm Citric Acid. There is no evidence that the concentrations of the Ammonium Fluoride or Citric Acid affect the performance of the present invention with respect to resist lifting. *The concentrations of these chemicals primarily affect the etch rate of the silicon dioxide.* The etchant works effectively with a bath temperature varying from 14 to 20°C. without any noticeable effect on resist lifting.

Bartlett teaches a particular etch solution of NH_4F:citric acid and *teaches away* from etch solutions of NH_4F:acetic acid or NH_4F:HF. Yamazaki teaches an etch solution of HF:NH_4F:acetic acid (1:50:50).

Neither of the cited references teach or suggest Applicant's methods utilizing an aqueous 2:1(v/v) solution of HF:organic acid (particularly HF:citric acid) to selectively remove dielectric material — particularly at a rate of greater than about 2000 Å/minute.

Accordingly, withdrawal of this rejection is respectfully requested.

As for the combination of Bell with Bartlett and Yamazaki, the Examiner cites Bell for teaching that chemistry for dielectric:photoresist selectivity greater than 40:1 can be readily tailored "in a wet etching process."

First, Applicant is unclear with regard to the Examiner's statement that it would be obvious to modify the etch solutions of Bartlett/Yamazaki to an "appropriate selectivity between the dielectric layer and the photoresist layer because high selectivity between dielectric and

photoresist layer will require a thinner in thickness of the photoresist layer." (Office Action at page 6, last par.) Applicant requests the Examiner to clarify the point being made.

As Bartlett and Yamazaki are inapplicable for the above-stated reasons, combining the teaching of Bell does not make up for the insufficiencies of the primary references.

Bell describes forming a nitride layer on the gate material layer and an ultra-thin photoresist layer over the nitride layer, and using an etch chemistry selective to the nitride layer over the photoresist layer. Bell <u>generally</u> states that a dry or wet etching technique can be used. Bell then describes a *dry etch* CH_3F chemistry. Bell does *<u>not</u>* disclose a wet chemistry formulation.

Thus, although Bell states that the nitride:photoresist etch selectivity may be within a range of 2:1 to greater than 40:1, and that the etch chemistry can be tailored to correspond to the characteristics of the nitride layer and patterned photoresist — Bell does not disclose any wet chemistry formulation and provides no information on modifying wet chemistry components to vary selectivity. None of the references provide any information on an aqueous solution of HF:organic acid to selectively etch dielectric.

The combination of Bell's disclosure with either Bartlett and/or Yamazaki does not teach or suggest Applicant's method as claimed. Accordingly, withdrawal of this rejection is respectfully requested.

Applicant believes that the claims are in condition for allowance, and notification to that effect is respectfully requested.

Respectfully submitted,

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Replacement Claims

WHAT IS CLAIMED IS:

~~1. A method of cleaning wafer surfaces, comprising the steps of:~~

~~providing a wafer surface bearing overlying material thereon; and~~

~~cleaning the wafer surface by removing at least a portion of the overlying material from the wafer surface by applying an aqueous solution comprising one or more inorganic fluorine-comprising compounds and one or more organic acids in a ratio of about 100:1 to about 55:45 (v/v), the solution having a pH of about 3 to about 9, such that the surface of the wafer is rendered substantially hydrophobic.~~

12. (amended) A method for surface treating wafer surfaces, comprising the steps of:

providing a wafer surface having a low-k dielectric layer disposed thereon and a photoresist layer overlying the dielectric layer; and

treating the wafer surface to remove at least a portion of the low-k dielectric layer with minimal removal of the photoresist layer, by applying an aqueous ~~solution of one or more inorganic fluorine-comprising compounds~~ 2:1 (v/v) solution of hydrofluoric acid and one or more organic acids, the solution having a pH of about 2 to about 6, such that the dielectric layer is selectively removed at a rate of greater than about ~~1000~~ 2000 angstroms per minute.

13. (amended) The method of Claim 12, wherein the aqueous solution comprises ~~at least~~ hydrofluoric acid and the one or more organic acids in a ratio of about 2:1 (v/v), such that the low-k dielectric layer is selectively removed at a rate of about 2300 to about 2700 angstroms per minute.

~~20. A method of cleaning wafer surfaces, the method comprising the steps of:~~

~~providing an aqueous solution comprising at least one inorganic fluorine-comprising compound selected from the group consisting of hydrofluoric acid and ammonium fluoride, and mixtures thereof; and at least one organic acid selected from the group consisting of citric acid, acetic acid, ascorbic acid, and mixtures thereof;~~

~~providing a wafer having a low-k dielectric material disposed on at least a portion of one surface; and~~

~~contacting the surface of the wafer having the low-k dielectric material thereon with the aqueous solution under conditions effective to remove at least a portion of the low-k dielectric material at a rate of about 50 to about 1000 angstroms per minute.~~

~~21. The method of Claim 20, wherein the aqueous solution comprises about 30 % to about 70 % by volume of the fluorine-comprising compound, and about 30 % to about 70 % by volume of the organic acid, based on the total volume of the solution.~~

26. (amended) A method of cleaning wafer surfaces, the method comprising the steps of:

providing an aqueous ~~solution comprising an inorganic fluorine-comprising compound selected from the group consisting of hydrofluoric acid and ammonium fluoride, and mixtures thereof;~~ 2:1 (v/v) solution comprising hydrofluoric acid and an organic acid selected from the group consisting of citric acid, acetic acid, ascorbic acid, and mixtures thereof;

providing a wafer having a low-k dielectric material disposed on at least a portion of one surface; and

contacting the surface of the wafer having the low-k dielectric material thereon with the aqueous solution under conditions effective to remove at least a portion of the low-k dielectric material at a rate greater than about 1000 angstroms per minute.

~~27. The method of Claim 26, wherein the aqueous solution includes at least hydrofluoric acid and one or more organic acids in a ratio of about 2:1 (v/v).~~

28. (amended) The method of Claim 26 ~~27~~, wherein the aqueous solution ~~includes~~ comprises about 63 to about 70 % by volume of hydrofluoric acid, and about 30 to about 36 % by volume of ~~the one or more organic acids.~~organic acid.

~~31. A method of surface treating wafer surfaces, comprising the steps of:~~

~~providing a wafer surface having a low k dielectric layer disposed thereon and a photoresist layer overlying the dielectric layer; and~~

~~providing an aqueous composition comprising at least one inorganic fluorine-comprising compound, and a major amount of one or more organic acids; and~~

~~32. The method of Claim 31, wherein the composition comprises an aqueous solution of at least hydrofluoric acid and the one or more organic acids in a ratio of about 1:100 to about 45:55 (v/v), such that the composition removes the photoresist mask substantially completely from the surface.~~

~~33. The method of Claim 31, wherein the inorganic fluorine-comprising compound is selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof; and the organic acid is selected from the group consisting of citric acid, gallic acid, acetic acid, formic acid, propionic acid, n-butyric acid, isobutyric acid, benzoic acid, ascorbic acid, gluconic acid, malic acid, malonic acid, oxalic acid, succinic acid, tartaric acid, and mixtures thereof.~~

~~34. The method of Claim 31, wherein the organic acid is selected from the group consisting of citric acid, acetic acid, ascorbic acid, and mixtures thereof.~~

~~35. The method of Claim 31, wherein the step of contacting the surface of the wafer comprises immersing the wafer in a bath of the composition, spraying the surface of the wafer with the composition, exposing the wafer to a vapor, or any combination thereof.~~

~~76. The method of Claim 1, wherein the inorganic fluorine-comprising compound is selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof.~~

~~77. The method of Claim 1, wherein the organic acid is selected from the group consisting of citric acid, gallic acid, acetic acid, formic acid, propionic acid, n-butyric acid, isobutyric acid, benzoic acid, ascorbic acid, gluconic acid, malic acid, malonic acid, oxalic acid, succinic acid, tartaric acid, and mixtures thereof.~~

~~78. The method of Claim 1, wherein the organic acid is selected from the group consisting of citric acid, acetic acid, ascorbic acid, and mixtures thereof.~~

79. <u>(amended)</u> A method of cleaning a surface of a semiconductor substrate, comprising the steps of:

applying an aqueous solution to remove ~~organic material and~~ low-k dielectric material from the surface of the substrate, the aqueous solution effective to selectively remove the <u>low-k</u> dielectric layer at a rate greater than about 2000 angstroms per minute; the aqueous solution comprising ~~one or more organic fluorine-comprising compounds~~ <u>a 2:1 (v/v) ratio of hydrogen fluoride</u> and one or more inorganic acids, and having a pH of about 2 to about ~~6~~ <u>5</u>.

~~80. A method of cleaning a surface of a semiconductor substrate, comprising the steps of:~~

~~applying an aqueous solution to the surface of the substrate to remove dielectric material and organic material and render the surface hydrophobic; the aqueous solution comprising an inorganic fluorine compound and an organic acid in a ratio of about 1:2 to about 2:1 (v/v), and having a pH of about 3 to about 6.~~

~~81. The method of Claim 80, wherein the aqueous solution removes the dielectric material at a rate of about 50 to about 1000 angstroms per minute.~~

~~82. The method of Claim 80, wherein the aqueous solution removes the dielectric material at a rate of about 50 to about 600 angstroms per minute.~~

~~83. The method of Claim 80, wherein the aqueous solution comprises hydrofluoric acid and an organic acid in a ratio of about 1:2 (v/v), and has a pH of about 3 to about 4; and the aqueous solution removes the dielectric material at a rate of about 400 to about 600 angstroms per minute.~~

~~84. The method of Claim 80, wherein the aqueous solution comprises ammonium fluoride and an organic acid in a ratio of about 2:1 (v/v), and has a pH of about 4 to about 6; and the aqueous solution removes the dielectric material at a rate of about 50 to about 150 angstroms per minute.~~

~~85. The method of Claim 80, wherein the step of contacting the surface of the wafer comprises immersing the wafer in a bath of the composition, spraying the surface of the wafer with the composition, exposing the wafer to a vapor, or any combination thereof.~~

~~86. A method of treating a surface of a semiconductor substrate, comprising the steps of:~~

~~applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material to render the surface hydrophobic, the aqueous solution comprising an inorganic fluorine compound and an organic acid in a ratio of about 1:2 to about 2:1 (v/v), and having a pH of about 3 to about 6; the inorganic fluorine compound selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof.~~

~~87. The method of Claim 86, wherein the organic acid is selected from the group consisting of citric acid, gallic acid, acetic acid, formic acid, propionic acid, n-butyric acid, isobutyric acid, benzoic acid, ascorbic acid, gluconic acid, malic acid, malonic acid, oxalic acid, succinic acid, tartaric acid, and mixtures thereof.~~

~~88. A method of treating a surface of a semiconductor substrate, comprising the steps of:~~

~~applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom and render the surface of the substrate hydrophobic; the aqueous solution comprising an inorganic fluorine compound and an organic acid in a ratio of~~

~~about 1:2 to about 2:1 (v/v), and having a pH of about 3 to about 6; the inorganic fluorine compound selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof; the organic acid selected from the group consisting of citric acid, acetic acid, ascorbic acid, and mixtures thereof.~~

~~89. A method of treating a surface of a semiconductor substrate, comprising the steps of:~~

~~applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom at a rate of about 400 to about 600 angstroms/minute to render the surface hydrophobic; the aqueous solution comprising hydrofluoric acid and an organic acid in a ratio of about 1:2 (v/v), and having a pH of about 3 to about 4.~~

~~90. A method of treating a surface of a semiconductor substrate, comprising the steps of:~~

~~applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom at a rate of about 50 to about 150 angstroms/minute to render the surface hydrophobic; the aqueous solution comprising ammonium fluoride and an organic acid in a ratio of about 2:1 (v/v), and having a pH of about 4 to about 6.~~

~~91. A method of treating a surface of a semiconductor substrate, comprising the steps of:~~

~~applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom at a rate of about 50 to about 150 angstroms/minute to render the surface hydrophobic; the aqueous solution comprising an inorganic fluorine compound and an organic acid in a ratio of about 30:70 to about 70:30 % by volume, and having a pH of about 3 to about 6.~~

~~92. The method of Claim 91, wherein the aqueous solution removes the dielectric material at a rate of about 50 to about 1000 angstroms per minute.~~

~~93. The method of Claim 91, wherein the aqueous solution removes the dielectric material at a rate of about 50 to about 600 angstroms per minute.~~

~~94. The method of Claim 91, wherein the aqueous solution comprises hydrofluoric acid and an organic acid in a ratio of about 30:70 to about 40:60 % by volume, and has a pH of about 3 to about 4, and the aqueous solution removes the dielectric material at a rate of about 400 to about 600 angstroms per minute.~~

~~95. The method of Claim 91, wherein the aqueous solution comprises ammonium fluoride and an organic acid in a ratio of about 60:40 to about 70:30 % by volume, and has a pH of about 4 to about 6, and the aqueous solution removes the dielectric material at a rate of about 50 to about 150 angstroms per minute.~~

~~96. A method of treating a surface of a semiconductor substrate, comprising the steps of:~~

~~applying an aqueous solution to the surface of the substrate to remove dielectric material from the surface of the substrate at a rate of about 400 to about 600 angstroms/minute; the aqueous solution comprising hydrofluoric acid and an organic acid in a ratio of about 30:70 to about 40:60 % by volume, and having a pH of about 3 to about 4.~~

~~97. A method of treating a surface of a semiconductor substrate, comprising the steps of:~~

~~applying an aqueous solution to the surface of the substrate to remove dielectric material therefrom at a rate of about 50 to about 150 angstroms per minute; the aqueous solution comprising ammonium fluoride and an organic acid in a ratio of about 60:40 to about 70:30 % by volume, and having a pH of about 4 to about 6.~~

~~98. A method of treating a surface of a semiconductor substrate, comprising the steps of:~~

~~applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom and render the surface hydrophobic; the aqueous solution comprising an organic fluorine compound and an inorganic acid in a ratio of about 1:5 (v/v).~~

~~99. The method of Claim 98, wherein the organic fluorine-comprising compound is selected from the group consisting of hydrogen fluoride pyridinium, tetramethylammonium fluoride, triethylamine trihydrofluoride, and mixtures thereof.~~

~~100. The method of Claim 98, wherein the aqueous solution removes the dielectric material at a rate of about 50 to about 1000 angstroms per minute.~~

~~101. A method of treating a surface of a semiconductor substrate, comprising the steps of:~~

~~applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom and render the surface substantially hydrophobic; the aqueous solution comprising an organic fluorine compound and an inorganic acid in a ratio of about 1:5 (v/v); the organic fluorine-comprising compound selected from the group consisting of hydrogen fluoride pyridinium, tetramethylammonium fluoride, triethylamine trihydrofluoride, and mixtures thereof.~~

~~102. The method of Claim 101, wherein the aqueous solution removes the dielectric material at a rate of about 700 angstroms per minute.~~

~~103. A method of treating a surface of a semiconductor substrate, comprising the steps of:~~

~~applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom to render the surface substantially hydrophobic; the aqueous solution comprising an organic fluorine compound and an inorganic acid in a ratio of about 1:5 (v/v); the organic fluorine-comprising compound selected from the group consisting of hydrogen fluoride pyridinium, tetramethylammonium fluoride, triethylamine trihydrofluoride, and mixtures thereof; and the inorganic acid selected from the group consisting of sulfuric acid, nitric acid, hydrochloric acid, phosphoric acid, and mixtures thereof.~~

~~104. A method of treating a surface of a semiconductor substrate, comprising the steps of:~~

~~applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom to render the surface substantially hydrophobic; the aqueous solution comprising hydrogen fluoride pyridinium and an inorganic acid in a ratio of about 1:5 (v/v).~~

~~105. A method of treating a surface of a semiconductor substrate, comprising the steps of:~~

~~applying an aqueous solution to the surface of the substrate to remove organic material and dielectric material therefrom to render the surface substantially hydrophobic; the aqueous solution comprising an organic fluorine compound and an inorganic acid in a ratio of about 13:86 to about 19:80 % by volume.~~

~~106. The method of Claim 105, wherein the organic fluorine-comprising compound is selected from the group consisting of hydrogen fluoride pyridinium, tetramethylammonium fluoride, triethylamine trihydrofluoride, and mixtures thereof.~~

~~107. The method of Claim 105, wherein the aqueous solution removes the dielectric material at a rate of about 50 to about 1000 angstroms per minute.~~

~~108. The method of Claim 105, wherein the aqueous solution removes the dielectric material at a rate of about 700 angstroms per minute.~~

~~109. A method of treating a surface of a semiconductor substrate, comprising the step of:~~

~~applying an aqueous solution to the surface of the semiconductor substrate to remove organic material and dielectric material therefrom at a rate of about 50 to about 1000 angstroms per minute to render the surface substantially hydrophobic; the aqueous solution comprising hydrogen fluoride pyridinium and an inorganic acid in a ratio of about 13:86 to about 19:80 % by volume.~~

~~110. The method of Claim 109, wherein aqueous solution removes the dielectric material at a rate of about 700 angstroms per minute.~~

111. (amended) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively remove low-k dielectric material and up to a minimal amount of organic material therefrom; the aqueous solution comprising ~~an inorganic fluorine compound~~ hydrofluoric acid and an organic acid in a ratio of about 2:1 (v/v), and having a pH of about 2 to about ~~6~~ 5.

112. The method of Claim 111, wherein the aqueous solution removes the dielectric material at a rate of greater than about 1000 angstroms per minute.

113. The method of Claim 111, wherein the aqueous solution removes the dielectric material at a rate of greater than about 2000 angstroms per minute.

114. The method of Claim 111, wherein aqueous solution removes the organic material at a rate of about 1 angstrom per minute.

115. The method of Claim 111, wherein the aqueous solution provides an etch selectivity ratio for the dielectric material to organic material of about 50:1 to about 1000:1.

116. (amended) The method of Claim 111, wherein the ~~inorganic fluorine-comprising compound is selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof.~~ aqueous solution further comprises ammonium fluoride.

117. The method of Claim 111, wherein the organic acid is selected from the group consisting of citric acid, gallic acid, acetic acid, formic acid, propionic acid, n-butyric acid, isobutyric acid,

benzoic acid, ascorbic acid, gluconic acid, malic acid, malonic acid, oxalic acid, succinic acid, tartaric acid, and mixtures thereof.

118. The method of Claim 111, wherein the organic acid is selected from the group consisting of citric acid, acetic acid, ascorbic acid, and mixtures thereof.

119. (amended) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively remove low-k dielectric material therefrom at a rate of greater than about ~~1000 angstroms~~ 2000 angstroms per minute; the aqueous solution comprising ~~an inorganic fluorine compound~~ hydrofluoric acid and an organic acid in a ratio of about 2:1 (v/v), and having a pH of about 2 to about 5 ~~6; the inorganic fluorine compound selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof~~.

120. (amended) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively remove low-k dielectric material therefrom at an etch selectivity ratio for the dielectric material to organic material of about 50:1 to about 1000:1; the aqueous solution comprising ~~an inorganic fluorine compound~~ hydrofluoric acid and an organic acid in a ratio of about 2:1 (v/v), and having a pH of about 2 to about 5 ~~6; the inorganic fluorine compound selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof.~~5.

121. (amended) The method of Claim 120, wherein the aqueous solution selectively removes the dielectric material at a rate of ~~greater than about 1000 angstroms~~ about 2300 to about 2700 angstroms per minute.

122. The method of Claim 120, wherein the aqueous solution selectively removes the dielectric material at a rate of greater than about 2000 angstroms per minute.

123. A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively remove low-k dielectric material and up to a minimal amount of organic material therefrom; the aqueous solution comprising hydrofluoric acid and an organic acid in a ratio of about 2:1 (v/v), and having a pH of about 2 to about 5.

124. The method of Claim 123, wherein the aqueous solution selectively removes the low-k dielectric material at an etch selectivity ratio for the dielectric material to organic material of about 50:1 to about 1000:1.

125. The method of Claim 123, wherein the aqueous solution selectively removes the dielectric material at a rate of greater than about 1000 angstroms per minute.

126. The method of Claim 123, wherein the aqueous solution selectively removes the dielectric material at a rate of greater than about 2000 angstroms per minute.

~~127. A method of treating a surface of a semiconductor substrate, comprising the step of:~~

~~applying an aqueous solution to the surface of the semiconductor substrate to selectively remove low-k dielectric material and up to a minimal amount of organic material therefrom; the aqueous solution comprising ammonium fluoride and an organic acid in a ratio of about 2:1 (v/v), and having a pH of about 3 to about 6.~~

~~128. The method of Claim 127, wherein the aqueous solution selectively removes the low-k dielectric material at an etch selectivity ratio for the dielectric material to organic material of about 50:1 to about 1000:1.~~

~~129. The method of Claim 127, wherein the aqueous solution selectively removes the dielectric material at a rate of greater than about 1000 angstroms per minute.~~

~~130. The method of Claim 127, wherein the aqueous solution selectively removes the dielectric material at a rate of greater than about 2000 angstroms per minute.~~

131. (amended) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively remove low-k dielectric material and up to a minimal amount of organic material therefrom; the aqueous solution comprising ~~an inorganic fluorine compound and an organic acid in a ratio of about 63:36 to about 70:30 % by volume,~~ about 63-70% hydrofluoric acid and about 30-36% organic acid, and having a pH of about 2 to about 6.

132. (amended) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively remove low-k dielectric material therefrom at a rate of greater than about ~~1000 angstroms~~ 2000 angstroms per minute; the aqueous solution comprising ~~an inorganic fluorine compound and an organic acid in a ratio of about 63:36 to about 70:30 % by volume,~~ about 63-70% hydrofluoric acid and about 30-36% organic acid, and having a pH of about 2 to about 6; ~~the inorganic fluorine compound selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof.~~

133. (amended) A method of treating a surface of a semiconductor substrate, comprising the step of:

applying an aqueous solution to the surface of the semiconductor substrate to selectively remove low-k dielectric material therefrom at an etch selectivity ratio for the dielectric material to organic material of about 50:1 to about 1000:1; the aqueous solution comprising ~~an inorganic~~

~~fluorine compound and an organic acid in a ratio of about 63:36 to about 70:30 % by volume;~~ about 63-70% hydrofluoric acid and about 30-36% organic acid; the composition having a pH of about 2 to about 6~~; the inorganic fluorine compound selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof~~.

~~134. A method of treating a surface of a semiconductor substrate, comprising the step of:~~

~~applying an aqueous solution to the surface of the semiconductor substrate to selectively organic material and up to a minimal amount of low-k dielectric material therefrom; the aqueous solution comprising an inorganic fluorine compound and an organic acid in a ratio of about 1:100 (v/v), and having a pH of about 3 to about 4.~~

~~135. The method of Claim 134, wherein the aqueous solution removes organic material at a rate of about 400 to about 600 angstroms per minute.~~

~~136. The method of Claim 134, wherein the aqueous solution selectively removes the organic material at an etch selectivity ratio for the organic material to dielectric material of about 200:1.~~

~~137. The method of Claim 134, wherein the aqueous solution removes the organic material at a rate of about 200 angstroms per minute and the dielectric material at a rate of about 1 angstrom per minute.~~

~~138. A method of treating a surface of a semiconductor substrate, comprising the step of:~~

~~applying an aqueous solution to the surface of the semiconductor substrate to selectively remove organic material therefrom at an etch selectivity ratio of about 200:1; the aqueous solution comprising hydrofluoric acid and an organic acid in a ratio of about 1:100 (v/v), and having a pH of about 3 to about 4.~~

~~139. The method of Claim 138, wherein the organic material comprises a photoresist material.~~

~~140. A method of treating a surface of a semiconductor substrate, comprising the step of:~~

~~applying an aqueous solution to the surface of the semiconductor substrate to selectively remove organic material therefrom at an etch selectivity ratio of the organic material to low-k dielectric material of about 200:1; the aqueous solution comprising up to about 2% by volume hydrofluoric acid and about 98-99% by volume aqueous organic acid, and having a pH of about 3 to about 4.~~

~~141. The method of Claim 140, wherein the organic acid is an about 20-60% aqueous solution.~~

~~142. (new) The method of Claim 111, wherein the method comprises selectively removing the dielectric layer at a rate of at least about 50 angstroms per minute.~~

~~143. (new) The method of Claim 143, wherein the method comprises selectively removing the dielectric layer at a rate of about 50 to about 150 angstroms per minute.~~

~~144. (new) The method of Claim 120, wherein the method comprises selectively removing the dielectric layer at a rate of at least about 50 angstroms per minute.~~

~~145. (new) The method of Claim 144, wherein the method comprises selectively removing the dielectric layer at a rate of about 50 to about 150 angstroms per minute.~~

146. ~~(new)~~ (amended) A method of treating a wafer surface, comprising the steps of:

providing a wafer surface bearing overlying material thereon, the overlying material comprises a dielectric layer and an overlying layer comprising an organic material; and

treating the wafer surface by removing at least a portion of the dielectric layer from the wafer surface by applying an aqueous solution comprising ~~one or more inorganic fluorine-comprising compounds~~ hydrofluoric acid and one or more organic acids in a ratio of about ~~100:1 to about 55:45~~ 2:1 (v/v), the solution having a pH of ~~about 3 to about 9~~ about 2 to about 5.

147. ~~(new)~~ (amended) The method of Claim 146, wherein the method comprises selectively removing the dielectric layer at a rate ~~of about 50 to~~ greater than ~~1000~~ about 2000 angstroms per minute.

148. ~~(new)~~ (amended) The method of Claim 147, wherein the method comprises selectively removing the dielectric layer at a rate of about ~~50 to about 150~~ 2300 to about 2700 angstroms per minute.

~~149. (new) The method of Claim 146, wherein the inorganic fluorine-comprising compound is selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof.~~

150. ~~(new)~~ The method of Claim 146, wherein the organic acid is selected from the group consisting of citric acid, gallic acid, acetic acid, formic acid, propionic acid, n-butyric acid, isobutyric acid, benzoic acid, ascorbic acid, gluconic acid, malic acid, malonic acid, oxalic acid, succinic acid, tartaric acid, and mixtures thereof.

151. ~~(new)~~ The method of Claim 146, wherein the organic acid is selected from the group consisting of citric acid, acetic acid, ascorbic acid, and mixtures thereof.

152. ~~(new)~~ (amended) A method for surface treating wafer surfaces, comprising the steps of:

providing a wafer surface having a dielectric layer disposed thereon and a photoresist layer overlying the dielectric layer; and

treating the wafer surface to remove at least a portion of the dielectric layer with minimal removal of the photoresist layer, by applying an aqueous ~~solution of one or more inorganic fluorine-comprising compounds~~ 2:1 (v/v) solution of hydrofluoric acid and one or more organic acids, the solution having a pH of about 2 to about ~~6,~~ 5, such that the dielectric layer is selectively removed at a rate of ~~at least about 50~~ greater than about 2000 angstroms per minute.

153. ~~(new)~~ (amended) The method of Claim 152, wherein the method comprises selectively removing the dielectric layer at a rate of ~~greater than 1000~~ about 2300 to about 2700 angstroms per minute.

~~154. (new) The method of Claim 152, wherein the method comprises selectively removing the dielectric layer at a rate of about 50 to about 150 angstroms per minute.~~

155. ~~(new)~~ (amended) A method of treating a surface of a semiconductor substrate, comprising the steps of:

applying an aqueous solution to the surface of the substrate to selectively remove dielectric material; the aqueous solution comprising ~~an inorganic fluorine compound~~ hydrofluoric acid and an organic acid in a ratio of about 2:1 (v/v), and having a pH of ~~about 3 to about 6.~~ about 2 to about 5.

~~156. (new) The method of Claim 155, wherein the aqueous solution removes the dielectric material at a rate of at least about 50 angstroms per minute.~~

157. ~~(new)~~ (amended) The method of Claim 155, wherein the method comprises selectively removing the dielectric layer at a rate of greater than ~~1000~~ about 2000 angstroms per minute.

158. ~~(new)~~(amended) A method of treating a surface of a semiconductor substrate, comprising the steps of:

applying an aqueous solution to the surface of the substrate to selectively remove dielectric material, the aqueous solution comprising ~~an inorganic fluorine compound~~ hydrofluoric acid and an organic acid in a ratio of about 2:1 (v/v), and having a pH of ~~about 3 to about 6; the inorganic fluorine compound selected from the group consisting of hydrofluoric acid, ammonium fluoride, and mixtures thereof;~~ about 2 to about 5; wherein the aqueous solution

removes the dielectric material at a rate of ~~at least about 50~~ greater than about 2000 angstroms per minute.